

IN THE CLAIMS:

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CLAIMS WHAT IS CLAIMED IS:

The following is a complete listing of claims in this application.

1. (currently amended) Exoskeleton interface apparatus for detecting the posture of a limb of ~~an~~ a user and/or for reflecting controlled forces on the user, ~~whose characteristic is that it comprises~~ comprising:

at least an element of interaction with ~~an operator~~ the user;

a plurality of rigid links pivotally connected in series, between said element of interaction and a rigid fixed link, by means of rotational joints ~~whose~~ having rotational axes which coincide substantially in operative conditions with the physiological axes of at least one limb of the user;

means arranged in said rigid fixed link for generating a motive or braking force;

means for transmitting said force to said rotational joints; and

means for measuring the angular position of said rotational joints.

wherein at least one said joint of the exoskeleton structure has open geometry.

2. (currently amended) Exoskeleton interface apparatus according to claim 1, wherein said rigid links comprise:

said rigid fixed link, or a base frame, connected to a fixed plane and operatively connected to a second rigid link by a first rotational joint having an axis of rotation;

a third rigid link operatively connected to said second rigid link by means of a second rotational joint having axis of rotation orthogonal to the axis of rotation of the first rotational joint;

a fourth rigid link operatively connected to said third rigid link by means of a third rotational joint with axis of rotation orthogonal to the axis of the second rotational joint; and

a fifth rigid link associated to said element of interaction operatively connected to said fourth rigid link by means of a fourth rotational joint.

3. (currently amended) Exoskeleton interface apparatus according to claim 2, wherein, when the exoskeleton interface apparatus is used for monitoring the motion of the shoulder, of the arm and of the wrist of ~~an operator~~ the user, the axes of the first, of the second and of the third rotational ~~joint~~ joints are incident in a point at the physiological centre of the shoulder, whereas the axis of the fourth rotational joint coincides with the physiological axis of the elbow.

4. (currently amended) Exoskeleton interface apparatus according to claim ~~1~~ 2, wherein said element of interaction is connected to the fifth rigid link by means of a fifth rotational joint, ~~for example a ring bearing,~~ for measuring the rotation of the wrist with respect to the forearm.

5. (currently amended) Exoskeleton interface apparatus according to claim 1, wherein ~~said~~ the applied force brakes ~~the~~ free movement of said rigid link due to ~~the~~ movement of a limb of the user.

6. (currently amended) Exoskeleton interface apparatus according to claim 1, wherein ~~said~~ the means for generating ~~said~~ force are ~~motors, in particular "torque motors",~~ torque motors with a high torque/mass ratio.

7. (currently amended) Exoskeleton interface apparatus according to claim 1, wherein each rotational joint is brought independently into rotation about the respective axis, by one of ~~said~~ the means for generating a force through said means for transmitting said force.

8. (currently amended) Exoskeleton interface apparatus according to claim 1, wherein said means for transmitting said force ~~comprise~~ comprises at least one tendon, ~~whereby the means for generating a force comprises a plurality of means therefor, and~~ each means for generating ~~said a~~ force is operatively connected to a rotational joint by said at least one tendon.

9. (currently amended) Exoskeleton interface apparatus according to claim 1, ~~in which~~ wherein the rotational axes of the rotational joints lay in different planes, ~~whereby and a plurality is provided of means is provided~~ for orienting said means for transmitting said force.

10. (currently amended) Exoskeleton interface apparatus according to claim 1, wherein said means for transmitting force are tensioning tendons, ~~said tendon orienting~~ means for ~~orienting~~ being provided in the form of idle pulleys spatially arranged along said rigid links.

11. (currently amended) Exoskeleton interface apparatus according to claim 2, wherein said at least one joint of the exoskeleton ~~structure interface apparatus having~~ has open geometry, ~~in particular is~~ said third rotational joint ~~has open geometry~~.

12. (currently amended) Exoskeleton interface apparatus according to claim 2, wherein on ~~the~~ each rotational axis of the first, third and fourth rotational joint, an integrated epicyclic reduction gear is mounted for reducing the masses of the rigid links at the same conditions of stiffness and applied force.

13. (currently amended) Exoskeleton interface apparatus according to claim 1, wherein said means for measuring the angular position of said rotational joints ~~are mounted directly on the~~ comprise a plurality of means therefor corresponding to each of the plurality of rotational joints

with each of the plurality of means therefor mounted directly on an axis of ~~said the~~ means for generating ~~said~~ force, in particular ~~said means for measuring being high resolution incremental encoders.~~

14. (new) Exoskeleton interface apparatus according to claim 13, wherein said means for measuring comprises high resolution incremental encoders.